

Work Order ID 72639

Wednesday, August 03, 2011 1:30:00 PM



PROTOTYPE

Page 1

Item ID: D4202-1

Accept



Setup Start



Revision ID:

Stop



Item Name: Spacer

Start Date: 8/3/2011 Start Qty: 40.00



Cust Item ID:

Required Date: 8/4/2011 Req'd Qty: 40.00

Customer:

Reference:

Approvals:

Process Plan:

[Signature]

Date:

Tooling:

Date:

QC:

Date:

SPC (Y/N):

Date:

Run Start



Stop



Sequence ID/
Work Center ID

Operation
Description

Set Up/
Run Hours

Tool ID

Tool #

Plan
Code

Accept
Qty

Reject
Qty

Reject
Number

Insp.
Stamp

Draw Nbr

Revision Nbr

D4202

B

100

0.00



Hardinge CNC LATHE SMALL

Hardinge

Memo

0.00

Hardinge CNC Lathe Small

1- Machine as per Folio FB015

FOLIO REV: *2/1*

DWG REV: *12*

2- Deburr

SA 11/8/13

49

110

QC2- Inspect parts off machine FAI/FAIB

0.00



QC

Memo

0.00

Quality Control

SA 10/8/13

49

Work Order ID 72639



Page 2

Wednesday, August 03, 2011 1:30:01 PM

Item ID: D4202-1

Accept



Setup Start



Revision ID:

Stop



Item Name: Spacer

Start Date: 8/3/2011 Start Qty: 40.00



Cust Item ID:

Required Date: 8/4/2011 Req'd Qty: 40.00



Customer:

Reference:

Run Start



Approvals: Process Plan: _____ Date: _____ Tooling: _____ Date: _____

Stop



QC: _____ Date: _____ SPC (Y/N): _____ Date: _____

Sequence ID/
Work Center ID

Operation
Description

Set Up/
Run Hours

Tool ID

Tool #

Plan
Code

Accept
Qty

Reject
Qty

Reject
Number

Insp.
Stamp

120

QC8- Inspect parts - second check

0.00



QC

Memo

0.00

Quality Control

*inspected to Rev B
0.053 w mark up
Smuslos (x48) counts*

125

PO 14621

0.00



Purchasing

Memo

0.00

Purchasing

send to Metcor for heat treating to condition T4

11-08-3

49

126

Receive & Inspect for Damage & Mat'l Certs

0.00



Packaging

Memo

0.00

Packaging

CL 11/08/18 49

Work Order ID 72639

Wednesday, August 03, 2011 1:30:01 PM



Page 3

Item ID: D4202-1

Accept



Setup Start



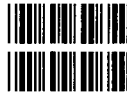
Revision ID:

Stop



Item Name: Spacer

Start Date: 8/3/2011 Start Qty: 40.00



Cust Item ID:

Required Date: 8/4/2011 Req'd Qty: 40.00



Customer:

Reference:

Run Start



Approvals: Process Plan: _____ Date: _____ Tooling: _____ Date: _____

Stop



QC: _____ Date: _____ SPC (Y/N): _____ Date: _____

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
--------------------------------	--------------------------	----------------------	---------	--------	--------------	---------------	---------------	------------------	----------------

127

QC6- Inspect dimensions to drawing

0.00



QC

Memo

0.00

Quality Control

8 mos/72 *ccurty*
(PYS)

130

Identify as per dwg & Stock Location: *LG*

0.00



Packaging

Memo

0.00

Packaging

****ATTENTION;
THIS IS FOR TESTING ONLY FOR SWAGING****

Dzn P.

PROTOTYPE

49 x 8 *BEU/08/29*

140

QC21- Final Inspection - Work Order Release

0.00



QC

Memo

0.00

Quality Control

MRF
11-08-30

Picklist Print

Wednesday, August 03, 2011 1:29:57 PM

Page 1

Work Order ID: 72639

Parent Item: D4202-1

Parent Item Name: Spacer



Start Date: 8/3/2011

Required Date: 8/4/2011

Start Qty: 40.00

Required Qty: 40.00

Comments: IPP REV:A NEW ISSUE 10-12-07 JLM VERIFIED:DD IPP
REV:B AS PER REV B 11-04-05 JLM VERIFIED BY:DD

Component Item ID/ Item Name	Replacement Item ID	Mfg/ Purch	Bin Item	Primary Location	Last Location	Route Seq ID	Unit of Measure	Qty on Hand	Qty per Kit	Total Qty	Qty Issued	Date Issued	Status
---------------------------------	------------------------	---------------	-------------	---------------------	------------------	-----------------	--------------------	----------------	-------------	--------------	---------------	----------------	--------

M6061T6T0.500W.058

Purchased

No

f

131.2000

14.74



6061-T6 RD Tube .500 x.058W

~~7821~~ SA 4/8/13

Location

Loc Qty

Loc Code

MAT014

131.2

117084

131.2


~~7821~~

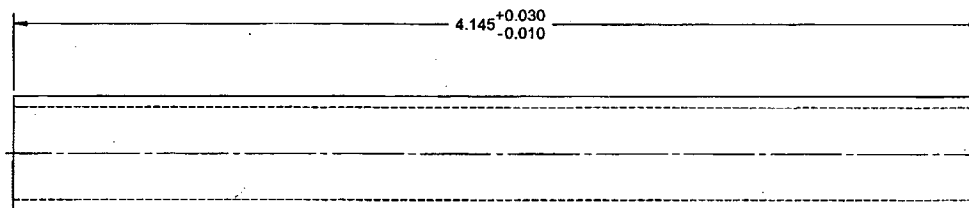
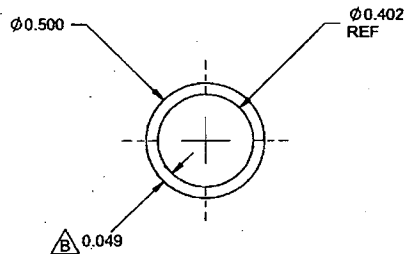
72639

7

フ

11/02/03





D4202-1 SPACER

W/072639

RELEASED
2011-03-31

058 11.08.03

NOTES:

- 1) MATERIAL: 6061-T6 ALUMINUM TUBING PER WW-T-700/6, AMS 4080, AMS 4082, QQ-A-200/8, OR QQ-A-225/8
REF DART SPEC M6061T6T0.500W.049
- 2) FINISH: NONE
- 3) TOLERANCES: PER DART QSI 018 UNLESS OTHERWISE NOTED
- 4) UNITS: INCHES UNLESS OTHERWISE NOTED
- 5) BREAK SHARP EDGES: 0.005 TO 0.010 MAX
- 6) IDENTIFICATION: NONE
- 7) WEIGHT: 0.03 lbs

B	0.049 WAS 0.058. REASON: FACILITATE MFG	MB	11.03.22
A	NEW ISSUE	CP	10.09.22
REV.	DESCRIPTION	BY	DATE
DESIGN			
DRAWN			
CHECKED			
MFG. APPR.			
APPROVED			
DE APPR.			
DATE	11.03.22		

DART AEROSPACE LTD
HAWKESBURY, ONTARIO, CANADA

DRAWING NO. **D4202** REV. B
SHEET 1 OF 1

TITLE **SPACER** SCALE NTS

COPYRIGHT © 2010 BY DART AEROSPACE LTD
THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS
NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT
WRITTEN PERMISSION FROM DART AEROSPACE LTD.



560 BOUL. ARTHUR-SAUVÉ
ST-EUSTACHE, QC J7R 5A8
Téléphone / Phone: 450-473-1884
Télécopie / Fax: 450-491-5498
Courriel / e-mail: ventes@metcor.biz / sales@metcor.biz
www.metcor.biz

SOUMISSION # 3135

Quotation #

Page: 1 / 1

Attn: Linda Lacelle

DART AEROSPACE
1270 ABERDEEN
HAWKESBURY ON K6A 1K7
Téléphone / Phone: 613-632-5200
Télécopie / Fax: 613-632-1053

Effectif / Effective: 04/11/2011
Expire / Expires: 04/05/2012
Termes / Terms: Net 30

Sujet aux conditions décrites ci-dessous / Subject to conditions below

Qté / Pièce Part Qty	# Pièce / Description / Prix Part # / Description / Price	Poid/unitaire Weight Per Part
720	Tubes 4" long X 0.5"od X0.049"w Matériel / Material: AL-6061	0
Traitement / Treatment: MISE EN SOLUTION / sol anneal		
	Ht to cond T4	\$586.00 lot
	Test conductibilité	\$1.80 / un

S.V.P. Inscrire le numéro de cette soumission sur votre bon de commande.

Please write the number of this quotation on your purchase order.

we can proceed 8 inch long part.

Alain Lemieux

METCOR INC. GARANTIE ET LIMITES DE RESPONSABILITE/ METCOR INC. WARRANTY AND STANDARD LIABILITY POLICY

Les travaux effectués par Metcor sont conformes aux procédures de qualité, selon les normes établies par NADCAP et ISO, et selon les instructions et spécifications fournies par le client. Cependant, Metcor ne peut assumer aucun risque inhérent à la nature même du traitement thermique, soit les déformations ou les ruptures qui peuvent survenir pendant et après le traitement. La responsabilité ainsi que la garantie de Metcor se limitent à la performance des travaux et des coûts tels que prévus à la soumission. Aucune responsabilité monétaire au-delà du coût du traitement en question ne sera acceptée. Toutes les plaintes concernant la qualité, les quantités ainsi que les poids doivent nous être communiquées par écrit dans les cinq (5) jours suivant la réception de la marchandise en question.

Metcor performs all its work under its NADCAP and ISO approved QA systems, as applicable, using approved procedures and specifications supplied by the customer. Metcor cannot assume any liability for deformations or ruptures that may occur as a result of inherent metallurgical properties of the material supplied. Metcor's warranty and liability is confined to the performance of the work and to the costs as quoted. No monetary responsibility or consequential costs will be accepted beyond the purchase order price / quoted cost. All complaints about quality, quantity or weight must be sent in writing to Metcor's address within five (5) days of receipt at customer.

Linda Lacelle

From: Eric Charbonneau <echarbonneau@dartaero.com>
Sent: August 3, 2011 12:46 PM
To: 'Linda Lacelle'
Subject: RE: swaging

D4202 with 6061-T6 .500 x .058w
Eric

From: Linda Lacelle [mailto:llacelle@dartaero.com]
Sent: August 3, 2011 11:53 AM
To: Eric Charbonneau
Subject: swaging

Do I use the D4202 drwg? What wall thickness have we finally decided on pls?

Thank You,
Linda Lacelle
Production Manager
Dart Aerospace Ltd
Hawkesbury, ON
Phone: 613 632 9577
Fax: 613 632 1053
Cell: 613 676 1655

40 pcs.

Linda Lacelle

From: David Shepherd <dshepherd@dartaero.com>
Sent: July 27, 2011 8:38 PM
To: 'Linda Lacelle'; 'Eric Charbonneau'; 'Bill Beckett'
Cc: 'Mike Petsche'; 'Chris Provencal'
Subject: RE: Crossbolt spacer swaging

Sorry Linda ... Only made that suggestion because I thought it might be easier to find than the 6061-T4, which I believe is a special order for you at this point. Is there any aluminum alloy that is easier to find with a lower tensile strength and a higher elongation % than 6061-T4???

David

-----Original Message-----

From: Linda Lacelle [mailto:llacelle@dartaero.com]
Sent: July-27-11 4:39 AM
To: 'Eric Charbonneau'; dshepherd@dartaero.com; 'Bill Beckett'
Cc: 'Mike Petsche'; 'Chris Provencal'
Subject: RE: Crossbolt spacer swaging

FYI, 5052 tubing is not an easy thing to get!!

-----Original Message-----

From: Eric Charbonneau [mailto:echarbonneau@dartaero.com]
Sent: July 26, 2011 3:46 PM
To: dshepherd@dartaero.com; 'Bill Beckett'
Cc: llacelle@dartaero.com; 'Mike Petsche'; 'Chris Provencal'
Subject: RE: Crossbolt spacer swaging

In theory 5052-H32 also has a max elongation of 12% but the UTS is much lower at 33 000 psi vs 45 000 psi for 6061-T6... might work.
Eric

-----Original Message-----

From: dshepherd@dartaero.com [mailto:dshepherd@dartaero.com]
Sent: July 26, 2011 3:37 PM
To: Bill Beckett
Cc: llacelle@dartaero.com; Mike Petsche; 'Chris Provencal'; 'Eric Charbonneau'
Subject: Re: Crossbolt spacer swaging

Bill,

My vague recollection here is that we tried the thin walled 6061-T4 tube, which is a special order, and like Eric says, determined that it was inferior to the existing welding process.

Before I suggested the stainless steel idea, I believe we were looking at trying a heavier wall 6061-T4 tubing (ie. Same size as we originally tried for 6061-T6 before the cracking started), which would again be a special order. Just wondering if heavier wall 5052-H32 tubing would be available off the shelf for this application? The idea here being

Linda Lacelle

From: Bill Beckett <bbeckett@darths.com>
Sent: July 26, 2011 3:46 PM
To: llacelle@dartaero.com
Cc: 'Mike Petsche'; dshepherd@dartaero.com; 'Chris Provencal'; 'Eric Charbonneau'
Subject: RE: Crossbolt spacer swaging

Linda,
Could you check out the 5052-H32 as suggested by David?
Bill

-----Original Message-----

From: dshepherd@dartaero.com [mailto:dshepherd@dartaero.com]
Sent: July 26, 2011 3:37 PM
To: Bill Beckett
Cc: llacelle@dartaero.com; Mike Petsche; 'Chris Provencal'; 'Eric Charbonneau'
Subject: Re: Crossbolt spacer swaging

Bill,

My vague recollection here is that we tried the thin walled 6061-T4 tube, which is a special order, and like Eric says, determined that it was inferior to the existing welding process.

Before I suggested the stainless steel idea, I believe we were looking at trying a heavier wall 6061-T4 tubing (ie. Same size as we originally tried for 6061-T6 before the cracking started), which would again be a special order. Just wondering if heavier wall 5052-H32 tubing would be available off the shelf for this application? The idea here being that the heavier wall tubing would provide a stronger swage and the test numbers would exceed the welding test numbers and we wouldn't have to accept a compromise.

To accept the 6061-T4 option, we all just have to agree to compromise.

David

Sent from my BlackBerry device on the Rogers Wireless Network

-----Original Message-----

From: "Bill Beckett" <bbeckett@darths.com>
Date: Tue, 26 Jul 2011 13:39:00
To: David Shepherd<dshepherd@dartaero.com>
Cc: <llacelle@dartaero.com>; 'Mike Petsche'<mpetsche@dartaero.com>; 'Chris Provencal'<cprovencal@dartaero.com>; 'Eric Charbonneau'<echarbonneau@dartaero.com>
Subject: RE: Crossbolt spacer swaging

David,
How can we determine if the 6061-T4 spacer is adequate?
Bill

-----Original Message-----

From: Eric Charbonneau [mailto:echarbonneau@dartaero.com]
Sent: July 26, 2011 1:30 PM
To: 'Bill Beckett'
Cc: llacelle@dartaero.com; 'Mike Petsche'; Chris Provencal
Subject: RE: Crossbolt spacer swaging

We did a sample with the SS crossbolt spacers and it deformed the skidtube ridge to the point that the saddle doesn't fit properly, I informed engineering... that's where it is. Personally I think we only have 2 options if we want to swage:

- 1- We swage a 6061-T6 at a much smaller diameter (0.410" instead of 0.437" this will keep us within the max expansion rate of 12%) but this means saddles and bushings need to be modified so they would not fit previous rev tubes.
- 2- We go with a 6061-T4 spacer at the original diameter of 0.437" and engineering performs the required test to ensure T4 temper is adequate or not, so far we rejected the T4 option because it is weaker than our welded spacers but this does not mean it's not strong enough for the application.

I do not see any other options than these if we want to swage.
Thanks,
Eric

-----Original Message-----

From: Bill Beckett [mailto:bbeckett@darths.com]
Sent: July 26, 2011 1:06 PM
To: Eric Charbonneau
Cc: llacelle@dartaero.com; Mike Petsche
Subject: Crossbolt spacer swaging

Eric,
Where do we stand with this project, and what are the next steps (and when).
Thanks,
Bill

=====

PLEASE NOTE OUR NEW CORPORATE OFFICE ADDRESS: 4650 North Avenue, Oceanside, California 92056

Disclaimer - This email and any files transmitted with it are confidential and may contain privileged or copyright information. You must not present this message to another party without gaining permission from the sender. If you are not the intended recipient you must not copy, distribute or use this email or the information contained in it for any purpose other than to notify us.

If you have received this message in error, please notify the sender immediately, and delete this email from your system. We do not guarantee that this material is free from viruses or any other defects although due care has been taken to minimize the risk.

Any views expressed in this message are those of the individual sender, except where the sender specifically states them to be the views of DART Helicopter Services.

Aluminum & Copper Tubing

For information about metal tubing, see page 124.

Rigid Aluminum Tubing

- Temperature Range: -112° to +300°F
- Bendable: No
- Flareable: No
- 1/2 Hard H14 Temper:
- Moderate tensile (stretching) strength
- Connect by welding

Also known as Alloy 3003-H14, this lightweight tubing contains manganese for strength. It is corrosion resistant and can be welded. This tubing has seamless construction. Use with water, air, oil, and hydraulic fluid. Meets ASTM B210 and Fed. Spec. WW-T-700/2. Tubing can be sterilized with steam (autoclaving).

To Order: Please specify 1-, 3-, or 6-ft. length.

OD	ID	Wall	Max. psi Toler. @ 75°F		Each		
					1 ft.	3 ft.	6 ft.
1/8"	0.144"	0.022"	±.003"	490	8978K11	\$2.15	\$3.84
1/4"	0.187"	0.035"	±.003"	580	8978K12	2.02	3.60
3/8"	0.305"	0.035"	±.003"	390	8978K13	3.09	5.52
1/2"	0.437"	0.035"	±.004"	290	8978K14	4.57	8.16
5/8"	0.377"	0.065"	±.004"	540	8978K15	7.53	13.44
3/4"	0.555"	0.035"	±.004"	230	8978K16	5.24	9.36
7/8"	0.495"	0.065"	±.004"	440	8978K17	9.27	16.56
1"	0.687"	0.035"	±.004"	190	8978K18	6.85	12.24

OD	ID	Wall	Max. psi Toler. @ 75°F		Each		
					1 ft.	3 ft.	6 ft.
3/4"	0.627"	0.065"	±.004"	360	8978K19	\$10.21	\$18.23
1"	0.937"	0.035"	±.004"	140	8978K21	7.53	13.44
1 1/4"	0.877"	0.065"	±.004"	270	8978K22	\$5.57	11.15
1 1/2"	1.187"	0.035"	±.005"	140	8978K23	8.60	15.36
1 3/4"	1.437"	0.035"	±.005"	120	8978K24	5.78	11.56
2"	1.377"	0.065"	±.005"	210	8978K25	8.00	15.99
2 1/2"	1.937"	0.035"	±.005"	110	8978K26	6.45	12.90

Easy-Bend Aluminum Tubing

- Temperature Range: -40° to +180°F
- Bendable: Yes, by hand
- Flareable: Yes
- Soft (Annealed) Type O Temper:
- Low tensile (stretching) strength
- Use flared fittings (see page 163)

Also known as Alloy 3003-O, this tubing is softer and more bendable than our other aluminum tubing. It has seamless construction. It has an OD tolerance of ±.003", except the 5/8" OD tubing which is ±.004". Use with water, air, alcohol, and oil. Meets ASTM B483-03, B483-75, and B483-95. Not rated for sterilization.

OD	ID	Wall	Max. psi @ 100°F	25-ft. Coils		50-ft. Coils	
				Each		Each	
1/8"	0.075"	0.025"	2380	5177K41	\$12.74	5177K11	\$21.23
1/4"	0.132"	0.028"	1696	5177K42	15.60	5177K12	26.00
3/8"	0.186"	0.032"	1426	5177K43	18.33	5177K13	30.55
1/2"	0.152"	0.049"	2324	5177K44	20.24	5177K25	33.73
5/8"	0.243"	0.035"	1230	5177K45	20.82	5177K14	34.70
3/4"	0.305"	0.035"	1008	5177K46	25.10	5177K15	41.84
7/8"	0.277"	0.049"	1459	5177K47	31.20	5177K16	52.00
1"	0.368"	0.035"	854	5177K48	29.03	5177K17	48.39
1 1/8"	0.437"	0.035"	741	5177K49	36.19	5177K18	60.32
1 1/4"	0.402"	0.049"	1063	5177K51	50.28	5177K26	83.80
1 1/2"	0.377"	0.065"	1450	5177K52	61.28	5177K19	102.14
1 3/4"	0.555"	0.035"	586	5177K53	39.33	5177K21	65.55
2"	0.527"	0.049"	836	5177K54	50.06	5177K22	83.43

Ultra-Corrosion-Resistant Aluminum Tubing

- Temperature Range: -452° to +400°F
- Bendable: Yes, with bending tool
- Flareable: Yes
- Soft (Annealed) Temper:
- Low tensile (stretching) strength
- Use flared fittings (see page 163)

This tubing is also known as Alloy 5052-O temper. It has a higher magnesium content than 6061 aluminum for higher strength and is excellent for marine applications because it stands up to salt water and corrosion. Also for use with hydraulic fluid. This tubing has seamless construction. Not rated for sterilization.

To Order: Please specify 1-, 3-, or 6-ft. length.

OD	ID	Wall	Max. psi @ 72°F		Each		
					1 ft.	3 ft.	6 ft.
3/16"	0.132"	0.028"	±.018"	1624	9929T11	\$5.48	\$9.79
1/4"	0.118"	0.035"	±.018"	2030	9929T12	7.13	12.73
5/16"	0.194"	0.028"	±.018"	1230	9929T13	7.48	13.36
3/8"	0.187"	0.035"	±.018"	1538	9929T14	8.20	14.64
1/2"	0.319"	0.028"	±.018"	827	9929T15	6.55	11.70
5/8"	0.305"	0.035"	±.018"	1033	9929T16	6.69	11.95
3/4"	0.437"	0.035"	±.018"	778	9929T17	10.00	15.15
7/8"	0.402"	0.049"	±.018"	1089	9929T18	8.84	15.78
1"	0.694"	0.028"	±.024"	416	9929T19	\$5.77	13.47
1 1/8"	0.687"	0.035"	±.024"	519	9929T21	5.96	13.91

Copper Tubing

- Temperature Range: -425° to +400°F
- Bendable: Straight: Yes, with bending tool
Coils: Yes, by hand
- Flareable: Yes

- Straight: Hard Temper: Moderate tensile (stretching) strength
- Coils: Soft Temper: Low tensile (stretching) strength

- Use brass compression and copper solder-joint fittings (see pages 148-151 and 196-197)

Also known as Alloy 122, this alloy has the best ability to conduct heat of any standard heat exchange material. Tubing has seamless construction. For **straight lengths**, the OD tolerance is ±.002" for OD sizes 1/8" to 1/2"; ±.003" for 5/8" to 1 1/4" OD sizes; ±.004" for 2" and 2 1/2" OD sizes; **coils** are soft and cannot hold these tolerances. Use with water, air, oil, and hydraulic fluid. Meets ASTM B75. Tubing can be sterilized with steam (autoclaving).

To Order: For straight lengths, please specify 1-, 3-, or 6-ft. length. For coils, please specify 10- or 50-ft. length.

Straight Lengths

Tube Size*	OD	ID	Wall	Max. psi @ 70°F		Each		
						1 ft.	3 ft.	6 ft.
1/8"	0.061"	0.032"	0.032"	3410	8967K86	2.57	3.73	
3/16"	0.124"	0.032"	0.032"	2120	8967K87	4.10	5.94	
1/4"	0.186"	0.032"	0.032"	1530	8967K88	4.10	5.94	
5/16"	0.311"	0.032"	0.032"	980	8967K89	8.77	12.71	
3/8"	0.245"	0.065"	0.065"	2240	8967K93	11.23	16.28	
1/2"	0.436"	0.032"	0.032"	720	8967K94	10.41	15.09	
5/8"	0.377"	0.065"	0.065"	1620	8967K96	7.93	18.25	26.45
3/4"	0.561"	0.032"	0.032"	570	8967K69	7.38	16.97	24.59
7/8"	0.495"	0.065"	0.065"	1270	8967K23	10.43	23.98	34.76
1"	0.686"	0.032"	0.032"	470	8967K74	6.66	15.32	22.21
1 1/8"	0.627"	0.065"	0.065"	1040	8967K38	11.65	26.79	38.83
1 1/4"	0.811"	0.032"	0.032"	400	8967K85	7.58	17.44	25.27
1 1/2"	0.745"	0.065"	0.065"	880	8967K21	13.33	30.66	44.43
1 3/4"	0.936"	0.032"	0.032"	350	8967K91	9.06	20.83	30.19
2"	0.877"	0.065"	0.065"	760	8967K31	16.64	38.26	55.45
2 1/2"	1.061"	0.032"	0.032"	310	8967K111	10.73	24.69	35.78
3"	0.995"	0.065"	0.065"	680	8967K33	19.79	45.51	65.96
3 1/2"	1.186"	0.032"	0.032"	280	8967K121	11.14	25.62	37.13
4"	1.127"	0.065"	0.065"	600	8967K351	20.80	47.85	69.35
4 1/2"	1.311"	0.032"	0.032"	250	8967K131	13.07	30.07	43.58
5"	1.245"	0.065"	0.065"	550	8967K371	24.31	55.92	81.05
5 1/2"	1.436"	0.032"	0.032"	230	8967K141	13.84	31.82	46.12

Straight Lengths (Cont.)

Tube Size*	OD	ID	Wall	Max. psi @ 70°F		Each		
						1 ft.	3 ft.	6 ft.
1 1/2"	1.377"	0.065"	0.065"	500	8967K391	\$23.86	\$54.88	\$79.53
1 3/4"	1.686"	0.032"	0.032"	200	8967K151	16.28	37.44	54.26
2"	1.627"	0.065"	0.065"	430	8967K421	27.11	62.36	90.38
2 1/4"	1.936"	0.032"	0.032"	170	8967K161	18.26	42.00	60.87
2 1/2"	1.877"	0.065"	0.065"	370	8967K441	31.59	72.66	105.30
2 3/4"	2.436"	0.032"	0.032"	130	8967K171	22.94	52.76	76.47
3"	2.377"	0.065"	0.065"	280	8967K461	39.47	90.79	131.58

Coils

Tube Size*	OD	ID	Wall	Max. psi @ 70°F		Each	
						10 ft.	50 ft.
1/8"	0.152"	0.049"	0.049"	2440	8955K112	\$21.18	\$52.96
1/4"	0.127"	0.065"	0.065"	3220	8955K231	27.71	69.27
3/8"	0.215"	0.049"	0.049"	1940	8955K241	30.57	76.42
1/2"	0.183"	0.065"	0.065"	2580	8955K251	37.15	92.88
5/8"	0.277"	0.049"	0.049"	1620	8955K121	31.44	78.59
3/4"	0.245"	0.065"	0.065"	2140	8955K261	45.66	114.16
7/8"	0.402"	0.049"	0.049"	1220	8955K141	48.15	120.37
1"	0.377"	0.065"	0.065"	1620	8955K151	60.45	151.13
1 1/8"	0.495"	0.065"	0.065"	1280	8955K171	48.12	192.47
1 1/4"	0.627"	0.065"	0.065"	1080	8955K271	52.96	211.83
1 1/2"	0.877"	0.065"	0.065"	800	8955K291	74.69	298.74

* Tube size is the accepted designation of the copper tubing industry; it's not an actual size.

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: _____ PAR #: _____ Fault Category: _____ NCR: Yes No DQA: _____ Date: _____

Resolution: _____ Disposition: _____ QA: N/C Closed: _____ Date: _____

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

NOTE: Date & initial all entries

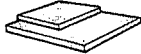
Aluminum

For information about aluminum alloys, see page 3602.

For information on the chemical composition of aluminum alloys, as well as physical and mechanical properties, go to mcmaster.com and search for 8975KAC.

High-Strength Aluminum (Alloy 2024) (Material continued from previous page)

Sheets—Unpolished (Mill) Finish



- Hardness: 120 Brinell
- Yield Strength: 42,000 to 50,000 psi
- Temper: T3, except 0.250" to 1.500" thicknesses are T351
- Meet ASTM B209. Width and length tolerances are $\pm 1/16$ ". Flatness tolerance is not rated.

		12" x 12"		12" x 24"		24" x 24"		24" x 48"		48" x 48"		48" x 72"	
Thick.	Tolerance	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each
0.020"	± 0.0025 "	88835K11	\$10.83	88835K18	\$19.49	88835K26	\$36.61	88835K34	\$65.32	88835K42	\$112.40	88835K211	\$145.00
0.025"	± 0.0025 "	88835K61	13.06	88835K62	24.29	88835K63	44.04	88835K64	82.89	88835K65	140.87	88835K212	187.88
0.032"	± 0.002 "	88835K12	14.38	88835K19	27.30	88835K27	51.44	88835K35	87.45	88835K43	152.06	88835K213	209.86
0.040"	± 0.002 "	88835K13	16.86	88835K21	32.18	88835K28	60.68	88835K36	106.18	88835K44	184.68	88835K214	245.06
0.050"	± 0.003 "	88835K14	20.24	88835K22	39.28	88835K29	70.03	88835K37	126.39	88835K45	215.97	88835K215	287.96
0.063"	± 0.003 "	88835K15	24.30	88835K23	44.42	88835K31	77.75	88835K38	141.41	88835K46	248.85	88835K216	333.27
0.080"	± 0.0035 "	88835K71	33.07	88835K72	55.03	88835K73	99.29	88835K74	176.98	88835K75	311.43	88835K217	409.77
0.090"	± 0.0035 "	88835K16	34.55	88835K24	63.19	88835K32	110.55	88835K39	201.11	88835K47	353.85	88835K218	457.59
0.100"	± 0.0035 "	88835K17	37.85	88835K25	68.71	88835K33	123.98	88835K40	236.79	88835K48	403.51	88835K219	503.38
0.125"	± 0.0035 "	88835K17	46.50	88835K25	80.85	88835K33	146.27	88835K41	273.01	88835K48	481.82	88835K221	614.33
0.160"	± 0.007 "	88835K91	53.93	88835K92	90.86	88835K93	165.13	88835K94	300.28	88835K95	571.96	88835K222	817.08
0.190"	± 0.007 "	88835K67	58.13	88835K68	101.15	88835K77	183.84	88835K78	334.30	88835K97	636.76	88835K223	909.66
		8" x 8"		12" x 12"		18" x 18"		24" x 24"					
Thick.	Tolerance	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each
0.250"	± 0.014 "		9040K51	\$39.61	9040K71	\$77.69	9040K61	\$154.19	9040K81	\$247.90			
0.375"	± 0.015 "		9040K52	54.11	9040K72	107.68	9040K62	208.51	9040K82	344.02			
0.500"	± 0.023 "		9040K53	64.24	9040K73	126.24	9040K63	252.80	9040K83	398.74			
0.750"	± 0.031 "		9040K54	97.30	9040K74	176.88	9040K64	352.03	9040K84	559.22			
1.000"	± 0.039 "		9040K55	111.44	9040K75	207.09	9040K65	405.15	9040K85	654.73			
1.250"	± 0.039 "		9040K56	141.28	9040K76	264.81	9040K66	518.15	9040K86	837.48			
1.500"	± 0.039 "		9040K57	153.35	9040K77	287.43	9040K67	562.41	9040K87	909.02			

Military Specification Sheets—Unpolished (Mill) Finish

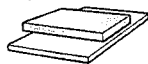


- Hardness: 120 Brinell • Yield Strength: 47,000 to 48,000 psi • Temper: T351

Meet ASTM B209. Sheets also meet MIL-S-2154 and are ultrasonically inspected (USI) for defects below the surface of the material. Width and length tolerances are $\pm 1/16$ ". Flatness tolerance is not rated.

		8" x 8"		12" x 12"		18" x 18"		24" x 24"	
Thick.	Tolerance	Each	Each	Each	Each	Each	Each	Each	Each
3/4"	± 0.037 "	1276T15	\$109.45	1276T16	\$234.54	1276T17	\$500.35	1276T18	\$781.80
1"	± 0.047 "	1276T19	127.60	1276T21	273.43	1276T22	583.31	1276T23	911.42
1 1/4"	± 0.047 "	1276T24	153.11	1276T25	328.09	1276T26	699.92	1276T27	1093.63
1 1/2"	± 0.047 "	1276T28	176.06	1276T29	377.27	1276T31	804.84	1276T32	1257.56
1 3/4"	± 0.060 "	1276T33	199.18	1276T34	426.81	1276T35	910.53	1276T36	1422.70
2"	± 0.060 "	1276T37	210.65	1276T38	451.39	1276T39	962.96	1276T41	1504.62

Tight-Tolerance Blanks with Material Certification—Precision Ground Finish



- Hardness: 120 Brinell • Yield Strength: 47,000 psi • Temper: T351

Meet ASTM B209. You won't need to prepare this material for machining. Precision ground blanks are consistently flat, square, and parallel on all sides. Each comes with a traceable lot number and physical test report. Tolerance for all dimensions is ± 0.002 ".

		2" x 12"		6" x 12"		8" x 8"		12" x 12"		12" x 24"		24" x 24"	
Thick.		Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each
1/4"	8509K11	\$78.79	8509K14	\$107.53	8509K15	\$92.13	8509K17	\$170.47	8509K19	\$308.89	8509K21	\$516.97	
3/8"	8509K22	83.30	8509K25	118.29	8509K26	111.24	8509K28	189.95	8509K31	345.02	8509K32	586.39	
1/2"	8509K33	103.28	8509K36	145.88	8509K37	135.07	8509K39	237.34	8509K42	449.36	8509K43	716.77	
5/8"	8509K44	107.49	8509K47	167.20	8509K48	156.50	8509K51	274.55	8509K53	494.33	8509K54	776.34	
3/4"	8509K55	117.21	8509K58	195.17	8509K59	181.11	8509K62	317.74	8509K64	580.08	8509K65	948.43	
1"	8509K66	131.91	8509K69	236.48	8509K71	212.15	8509K73	398.74	8509K75	681.96	8509K76	1144.15	

Tubes—Unpolished (Mill) Finish



- Hardness: 120 Brinell • Yield Strength: 42,000 psi • Temper: T3
- Meet ASTM B210. Straightness tolerance is not rated. Length tolerance is ± 1 ".

To Order: Please specify 3- or 6-ft. length.

		3 ft.		6 ft.				3 ft.		6 ft.			
OD	ID	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each
0.035" Wall Thickness (± 0.004")													
1/4"	0.180"	1968T12	\$19.49	\$33.60				0.058" Wall Thickness (Cont.)					
3/8"	0.305"	1968T66	26.53	45.75				5/8"	0.509"	1968T79	\$41.92	\$72.27	
1/2"	0.430"	1968T15	19.88	34.28				3/2"	0.634"	1968T83	32.68	56.34	
5/8"	0.555"	1968T77	35.98	62.04				7/8"	0.759"	1968T87	35.81	61.74	
1"	0.930"	1968T17	22.18	38.25				0.065" Wall Thickness (± 0.007")					
1 1/2"	1.430"	1968T47	32.66	56.31				1/4"	0.120"	1968T22	17.25	29.75	
0.049" Wall Thickness (± 0.005")								3/8"	0.245"	1968T69	30.31	52.26	
3/8"	0.277"	1968T67	25.63	44.19				1/2"	0.370"	1968T24	19.71	33.98	
1/2"	0.402"	1968T73	27.51	47.43				5/8"	0.495"	1968T81	27.79	47.91	
5/8"	0.527"	1968T78	31.44	54.21				3/4"	0.620"	1968T26	21.70	37.41	
7/8"	0.777"	1968T86	31.08	53.58				7/8"	0.745"	1968T88	34.94	60.24	
1"	0.902"	1968T92	31.72	54.69				1"	0.870"	1968T37	30.59	52.74	
0.058" Wall Thickness (± 0.006")								1 1/2"	1.370"	1968T49	49.03	84.54	
3/8"	0.259"	1968T68	21.85	37.68				2"	1.870"	1968T57	83.88	144.62	
1/2"	0.384"	1968T74	35.53	61.26				2 1/2"	2.370"	1968T61	104.51	180.19	
								3"	2.870"	1968T65	131.92	227.44	
0.083" Wall Thickness (± 0.008")													
1/2"	0.334"	1968T75	\$28.15	\$48.54				0.095" Wall Thickness (± 0.010")					
5/8"	0.459"	1968T82	27.61	47.61				1/2"	0.310"	1968T76	27.44	47.31	
3/4"	0.584"	1968T84	33.48	57.72				3/8"	0.560"	1968T85	45.19	77.91	
1"	0.834"	1968T93	43.03	74.19				7/8"	0.685"	1968T89	44.77	77.19	
0.120" Wall Thickness (± 0.012")								1"	0.810"	1968T94	44.82	77.28	
1/2"	0.260"	1968T23	31.16	53.73				0.120" Wall Thickness (± 0.012")					
3/4"	0.510"	1968T33	43.43	74.88				1/2"	0.260"	1968T23	31.16	53.73	
7/8"	0.635"	1968T91	47.07	81.16				3/8"	0.510"	1968T33	43.43	74.88	
1"	0.760"	1968T99	48.98	84.45				7/8"	0.635"	1968T91	47.07	81.16	
1 1/2"	1.260"	1968T51	54.36	93.73				1"	0.760"	1968T99	48.98	84.45	

(Material continued on following page)

Warning! Hardness and yield strength are not guaranteed and are intended only as a basis for comparison.

McMASTER-CARR

3613

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: _____ PAR #: _____ Fault Category: _____ NCR: Yes No DQA: _____ Date: _____

Resolution: _____ Disposition: _____ QA: N/C Closed: _____ Date: _____

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

NOTE: Date & initial all entries



Metcor Inc.

Metcor Inc.
560, boul. Arthur-Sauvé
St-Eustache (Québec) J7R 5A8
Tél.: (450) 473-1884
Fax Administration: (450) 491-5498
Fax Production: (450) 491-6454

Certificat de Conformité Certificate of Compliance

RON DE TRAVAIL order	CHARGEMENT load
168440	9

CLIENT / CLIENT: 215

DART AEROSPACE

1270 ABERDEEN

HAWKESBURY

ON K8A 1K7

LIVRÉ À / shipped to:

DART AEROSPACE

1270 ABERDEEN

HAWKESBURY

ON K8A 1K7

COMMANDE DU CLIENT customer no	RON DE LIVRAISON DU CLIENT customer shipment no.	MATÉRIEL material	CODE DE TRAITEMENT metal heat code	NUMÉRO DE LOT lot number
168440		AL-5051		

SPECIFICATIONS DU PROCÉDÉ

processing specifications

SOL ANNEAL

EMBLE AGING TO CONDITION T42

=

EXIGENCE / requirement	SPECIFICATIONS / specified	TESTS EXÉCUTÉS / performed	RÉSULTATS DE TESTS / results
CONDUCTIVITY	35 - 43 %IACS	10	38 - 39 %IACS
HARDNESS	60 HREW/MIN	10	55 - 66 HREW
DURETÉE MESURÉE EN HR15TW = 55.3-57 HR15TW			

QUANTITÉ quantity	POIDS weight	DESCRIPTION DES PIÈCES parts description
40	1.64	04202-1 1 BOITE DE CARTON

COMMENTAIRES / comments

INSPECTEUR / inspector	DATE
<i>[Signature]</i>	2011-08-12

OK P11.08.12



Dart Aerospace Ltd.
1270 Aberdeen Street
Hawkesbury, ON K6A 1K7
Tel: 613 632 9577
Fax: 613 632 1053

PO REPRINT

Purchase Order ID PO14621

Purchase Order Date 8/3/2011

PO Print Date 8/5/2011

Page Number 1 of 1

Order From :

VC-MET004

METCOR INC.
560 BOUL. ARTHUR SAUVE
SAINT-EUSTACHE, QC J7R 5A8
CA

Contact Name
Vendor Phone 450 473 1884
Vendor Fax 450 491 5498
Vendor Account Nbr

Buyer Brigitte Golden
Requisition Nbr
Tax Resale Nbr 10127-2607
Terms Net 30
Currency CAD
FOB Destination-Collect

Ship To : DART AEROSPACE LTD 1270 ABERDEEN
HAWKESBURY, ON K6A 1K7
CANADA

Line Nbr	Reference Revision ID Vendor Part Number	Description/ Mfg ID	Req Date/ Taxable	Req. Qty/ Unit of Measure	Ship Method	Unit Price	Extended Price
1	72639	D4202-1 Heat treat to condition T4	8/10/2011 Yes	49.00	FedEx Overnight	\$13.9600	\$684.04

PO Total: \$684.04

CL1108118

Change Nbr: 3

Change Date: 8/5/2011

No substitution or deviation without
consent.
Certificate of Conformity or Material
Certification required when applicable

METCOR INC.

560 BOUL. ARTHUR-SAUVE
ST-EUSTACHE, QC J7R 5A8
Tel: 450-473-1884 / Fax: 450-491-5498

Recu de Livraison

Order	Shipper	Shipping Seq.
168440	1	53188

Shipped Complete

Customer 215

DART AEROSPACE
1270 ABERDEEN
HAWKESBURY, ON K6A 1K7
Ph: 613-632-5200
Fax: 613-632-1053

Shipped To:

DART AEROSPACE
1270 ABERDEEN
HAWKESBURY, ON K6A 1K7
Ph: 613-632-5200
Fax: 613-632-1053

Purchase Order Number	Customer Shipper No.	Material Type	Order Date	Carrier
14621		AL-6061	2011/8/4	FEDEX
Quantity	Part No. / Part Name / Part Description			Pounds
49	D4202-1			1,64
	1 BOITE DE CARTON ✓			

CL11/0813

Container Type	# Of Containers	Container Comments
BOITE DE CARTON	1	

PACKING	
----------------	--

Quantity Shipped: 49
Pounds Shipped: 1,64
Quantity Remaining: 0
Pounds Remaining: 0,00

Quantity Shipped: 49

Pounds Shipped: 1,64

Signature: _____

Date: _____

Shipped ON: 2011/08/12